

WHAT IS CLAIMED IS:

1. A method of forming dual work function metal gate electrodes in a semiconductor device, comprising:

forming a gate dielectric over a substrate;

depositing a mold layer having a first opening therein over said gate dielectric; and

creating a first metal gate electrode by depositing a first metal in said first opening.

2. The method as recited in Claim 1 further including creating a second metal gate electrode over said substrate.

3. The method as recited in Claim 2 wherein creating said second metal gate electrode includes forming a second opening in said mold layer and depositing a second metal in said second opening.

4. The method as recited in Claim 2 wherein creating said second metal gate electrode includes removing said mold layer and forming a second mold layer having a second opening therein and depositing a second metal in said second opening.

5. The method as recited in Claim 4, wherein first and
2 second mold layers have different chemical compositions.

6. The method as recited in Claim 1, wherein said mold layer
2 is selected from the group consisting of
3 a resist material;
4 an organic polymer; and
5 an inorganic material.

7. The method as recited in Claim 1, wherein said mold
2 layer is substantially removed after depositing said first and
3 second metal.

8. The method as recited in Claim 1, wherein said first
2 metal has a work function between about 4 and about 4.2 eV and said
3 second metal has a work function between about 5 and about 5.2 eV.

9. The method as recited in Claim 1, wherein said first
2 metal is selected from the group consisting of:
3 titanium;
4 chromium;
5 manganese;
6 zirconium;
7 tantalum;

8 tantalum nitride; and
9 mixtures thereof.

10. The method as recited in Claim 1, wherein said first
2 metal is selected from the group consisting of:

3 cobalt;
4 nickel;
5 molybdenum;
6 ruthenium;
7 rhodium;
8 palladium;
9 rhenium;
10 iridium;
11 platinum;
12 gold; and
13 mixtures thereof.

11. The method as recited in Claim 2, wherein said creating
2 said first and second metal further includes removing excess first
3 and second metals located above said mold layer.

12. The method as recited in Claim 11, wherein said removing
2 includes chemical mechanical polishing one or both of said first
3 and second metals.

13. The method as recited in Claim 11, wherein said removing
2 includes dry etching one or both of said first and second metals.

14. The method as recited in Claim 1, further including
2 forming source and drain structures that are self-aligned with at
3 least one of said first and second metals.

15. An active device, produced by the process comprising:

forming a gate dielectric over a substrate;

depositing a mold layer having a first opening therein

over said gate dielectric; and

creating a first metal gate electrode by depositing a

first metal in said first opening.

16. The active device produced by the process recited in

Claim 15, further including creating a second metal gate electrode

over said substrate by forming a second opening in said mold layer

and depositing a second metal in said second opening.

17. The active device produced by the process recited in

Claim 15, further including creating a second metal gate electrode

over said substrate by removing said mold layer and forming a

second mold layer having a second opening therein and depositing a

second metal in said second opening.

18. A method of manufacturing an integrated circuit
comprising:

forming active devices having dual work function metal gate
electrodes over or in a semiconductor substrate including:

forming a gate dielectric over a substrate;

depositing a mold layer having a first opening therein
over said gate dielectric; and

creating a first metal gate electrode by depositing a
first metal in said first opening;

forming interconnect metals lines on one of more insulating
layers located over said active devices; and

connecting said interconnects with said active devices to form
an operative integrated circuit.

19. The method as recited in Claim 18, further including
creating a second metal gate electrode over said substrate by
forming a second opening in said mold layer and depositing a second
metal in said second opening.

20. The method as recited in Claim 18, further including
creating a second metal gate electrode over said substrate by
removing said mold layer and forming a second mold layer having a
second opening therein and depositing a second metal in said second
opening.